

DEPARTMENT OF HEALTH SERVICES

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Health Considerations of Vinyl Chloride
Emissions at the BKK Landfill

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Vinyl Chloride, Production and Use

Vinyl chloride is a synthetic organic chemical. It is widely used in industry, primarily in the polymerization process to produce polyvinyl chloride (PVC) plastics and resins. Until 1974, vinyl chloride was commonly used as a propellant in household aerosol spray products such as hairspray, room deodorants and furniture polish.

Toxicology of Vinyl Chloride

● Short-term (acute) Toxicity

Vinyl chloride is moderately toxic by inhalation, the primary route of human exposure. Studies have shown that prolonged exposure to vinyl chloride at levels in excess of 500 ppm can cause liver damage. Additionally, at these exposure levels, effects including skin lesions, headache, nausea, respiratory problems, and chromosome damage have been reported (U.S. EPA 1974). Other studies (NIOSH, 1975) gave no evidence of causing fetal malformation. However, one substudy indicated a potential link between increased incidence of spontaneous abortion among wives of workers exposed to high levels (excess of 500 ppm) of vinyl chloride. No acute health effects have been documented below exposure levels of 50 ppm.

● Carcinogenic Effects

Animal studies have shown that liver angiosarcomas have been produced at exposure levels of 50 ppm. In one experiment, exposure levels of 50 ppm for 4 hours a day, 5 days a week for a 12-month period produced kidney and liver tumors, as well as other tumors in organs such as brain, lung, and mammary glands (Maltoni, 1975). The liver seems to be the most affected organ, with susceptibility appearing to be sex-specific (male affected more than female animals). Recent experiments by Maltoni (Rawls, 1980) have shown that inhalation of as little as 10 ppm of vinyl chloride and ingestion of as little as 0.3 milligrams of vinyl chloride per kilogram of body weight cause liver angiosarcoma and other tumors in animals. Actual vinyl chloride exposure levels responsible for these effects in humans are not precisely known. Short-term microbial assays indicate mutagenic activity of vinyl chloride.

Regulation of Vinyl Chloride

Prior to establishment of the carcinogenic potential of vinyl chloride, it was regulated based on its moderately acute (short-term) toxicity. The occupational standard for exposure was 500 ppm, but no community standard existed. Following the discovery in 1974 of the relationship between occupational exposure and a rare form of liver cancer (angiosarcoma), the occupational standard was lowered to 1 ppm. In California, an ambient air standard was established in 1978 at 0.01 ppm. This standard was based on the limits of practical detection and control feasibility. It does not represent a zero, or completely safe level of exposure to vinyl chloride.

Since vinyl chloride is a proven human and animal carcinogen, exposure to any concentration of vinyl chloride involves some cancer risk. The people of California have enacted laws to ensure that involuntary exposure to environmental chemicals entails extremely low levels of risk. Because of this, environmental standards and subsequent regulatory and abatement actions are instituted at levels below those for which most individuals are subject to substantial risk. Setting such stringent standards for regulatory action ensures a large margin of safety.

Vinyl Chloride and Health Risk of BKK

Systematic monitoring for vinyl chloride began in June, 1981, after vinyl chloride was first detected by the South Coast Air Quality Management District in excess of the State standard. Air sampling stations were purposely set up in the locations expected to have the highest levels and the most exceedences. SCAQMD has recorded exceedences of this limit-of-detection standard in a range from 0.01 to 0.05 ppm around homes just off-site at BKK.

Averaging the vinyl chloride emissions over the year 1981, and extrapolating from animal cancer studies, the estimated lifetime added risk of cancer is about 2 in 1,000,000 in the affected nearest residences. Assuming the same level of exposure existed since the earliest residential occupancy (6.5 yrs.), the estimated added lifetime risk is approximately 1 in 100,000. Thus, the odds are against an added case of cancer in the exposed population as a result of vinyl chloride emissions at BKK.

What about other carcinogens at BKK, such as benzene? Previous measurements have indicated that on two occasions, benzene and chloroform exceeded ambient levels in the Los Angeles Basin by a factor of 2. Yet, the information available to us is simply not sufficient to make trustworthy risk assessments. Rough calculations based on pessimistic assumptions about preexistent levels of other carcinogens suggest low-risk levels (less than 1 in 10,000). More reliable estimates will be made after the planned monitoring system provides more detailed analysis of the gas collection system and air in the surrounding neighborhood.

The average American has a 25% chance of developing some form of cancer in his or her life. Two hundred and fifty (250) of the 1,000 residents living nearest the site would be expected to develop cancer in their lifetimes, regardless of where they had lived. However, the risk of cancer is increased by many activities. For example, the risk of cancer from a single chest X-ray is 1 in 100,000. The combined risk from cancer and heart disease from cigarette smoking is about 1 in 5 for a one-pack-a-day smoker and about 4 in 10,000 from living with a cigarette smoker. But those are "voluntary" risks. Using the same methods of extrapolation, one can estimate that 6.5 years of exposure to ambient levels of air pollutants in the Los Angeles Basin in a residence remote from BKK has a risk of 2 in 10,000.

The Department's conclusions are that the involuntary added risk from the vinyl chloride emissions from BKK does not warrant acute anxiety or drastic personal actions, but it is clearly cause for rigorous regulatory action in order to meet State policy on minimum public health risk. For this reason, vinyl chloride disposal at BKK was banned and a rigorous regulatory effort implemented to mandate a gas collection and flaring system to reduce vinyl chloride emissions to a minimum.

These mitigation steps have resulted in a steady decline in both the number and level of exceedences in the past year. Only one exceedence has been detected to date--in June, 1982. Monitoring continues at the two sites that historically have had the highest levels. As part of the most stringent regulatory effort to assure the safe handling of hazardous wastes at BKK, air monitoring will be expanded to additional stations to improve monitoring for vinyl chloride and

potential emissions of other chemicals. The State is ready to take immediate regulatory action as warranted by any new findings in order to guarantee public health protection within the safety margins of California's air standards,